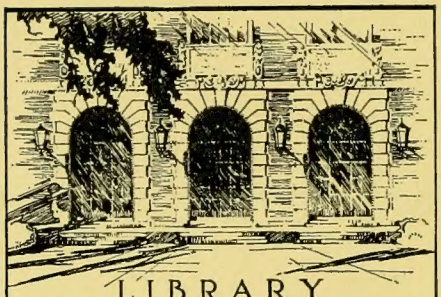
SHOUT
SHARE
IT

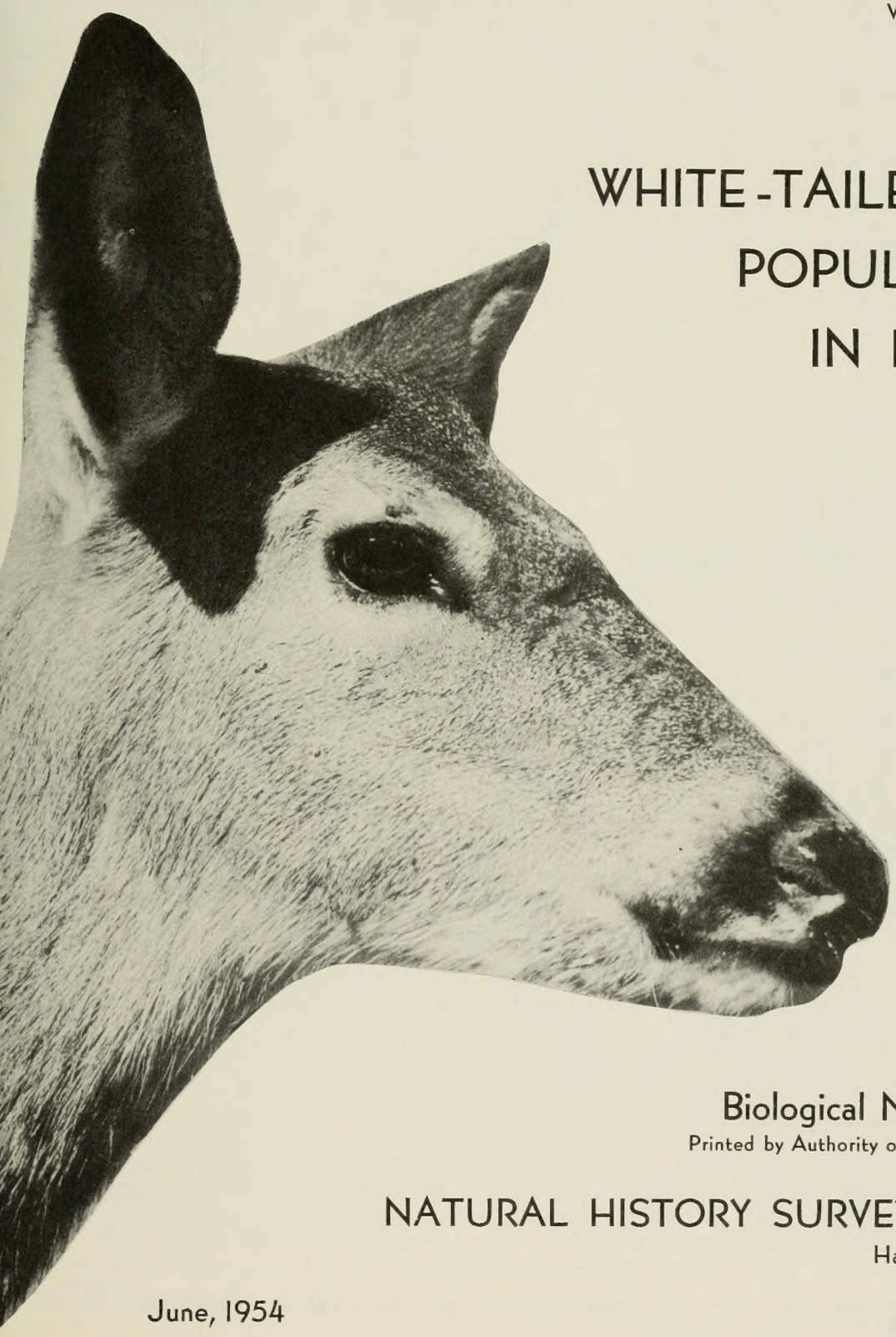


LIBRARY
OF THE
UNIVERSITY
OF ILLINOIS

cop.2

NATURAL HISTORY
SURVEY

STATE OF ILLINOIS
William G. Stratton, Governor
DEPARTMENT OF REGISTRATION AND EDUCATION
Vera M. Binks, Director



WHITE-TAILED DEER POPULATIONS IN ILLINOIS

Lysle R. Pietsch

Biological Notes No. 34
Printed by Authority of the State of Illinois

NATURAL HISTORY SURVEY DIVISION
Harlow B. Mills, Chief

June, 1954

Urbana, Illinois

NATURAL

Fig. 1. -- White-tailed deer on the Rock River range southwest of Rockford. This picture was taken on an aerial census of deer in February, 1947.

WHITE-TAILED DEER POPULATIONS IN ILLINOIS*

Lysle R. Pietsch†

In recent years, the public has become more and more aware of increasing numbers of white-tailed deer, Odocoileus virginianus (Boddaert), in Illinois, figs. 1, 2, and 3. The appearance of this deer in areas previously unoccupied within the memory of persons now living has been attended with keen interest and usually with enthusiasm. Once a herd of deer has become established, however, and it has been found responsible for losses to crops and browse plants, the landowners concerned have often expressed disapproval and have requested assistance with its management.

In response to complaints of landowners in critical areas, the Illinois Department of Conservation in 1942 initiated a program of trapping and redistributing nuisance deer. The action precipitated questions as to (1) the effectiveness of the program in reducing destruction of field crops and woody plants, (2) the suitability of habitat in which releases of deer might be made, and (3) the subsequent success of releases. The Department was concerned with the problem of determining whether this increasing game species should be hunted. Some sportsmen, the bow-and-arrow enthusiasts in particular, expressed the belief that deer numbers had reached such proportions in some areas of Illinois that a limited amount of deer hunting could and should be permitted.

The need for answers to the above questions resulted in the creation of a research project for deer. This project, undertaken by the Illinois Natural History Survey in the fall of 1946, was continued until April 1, 1947, when the Illinois Natural History Survey and the Illinois Department of Conservation entered into a co-operative agreement concerning deer research and set up Illinois Federal Aid Project No. 33-R under terms of the Federal Aid in Wildlife Restoration Act. The second project was terminated on June 30, 1951. The data presented in this paper were, with a few minor exceptions, collected during the life of the two projects.

Acknowledgments

The research involved in the deer projects and reported upon here was done under the direction of Dr. Harlow B. Mills, Mr. Willet N. Wandell, and Dr. Thomas G. Scott, all of the Illinois Natural History Survey. Dr. Scott and Mr. James S. Ayars, Illinois Natural History Survey, contributed importantly to the preparation of this manuscript for publication. Director Glen D. Palmer, Mr. Louis Martin, and Mr. Joe B. Davidson of the Illinois Department of Conservation gave encouraging interest that was highly valued. Mr. Clayton C. Swears, Mr. Edward A. Fitzgerald, Mr. William Cloe, and Mr. William D. Carter, as employees of the Illinois Department of Conservation, contributed much useful data.

The photographs were made by several staff members of the Department of Conservation and the Natural History Survey: Mr. Wandell and Mr. William E. Clark of the Survey, the author, and others.

Thanks are due for helpful assistance by conservation officers in all parts of the state, especially for that of Mr. Paul Beebe of Ogle County; also for the friendly co-operation of farmers in the Rock River range, particularly that of Mr. Thomas E. Colloton and Mr. William I. Boetcher.

Early Status

When white settlers arrived in Illinois early in the eighteenth century, deer were common here, but probably not numerous. At that time the native vegetation consisted largely of extensive areas of two basic types of plant communities, the prairie and the hardwood forest. These, within themselves, probably did not support an abundance of deer. It was where the prairies and forests merged, comprising the "edge," and in the forest openings that deer were found in large numbers.

A statement on the habits of Illinois deer by

*/ This paper is based upon findings of Illinois Federal Aid Project No. 33-R, the Illinois Department of Conservation, the United States Fish and Wildlife Service, and the Illinois Natural History Survey, co-operating.

†/ Employed by the Illinois Department of Conservation under terms of the Federal Aid in Wildlife Restoration Act and assigned to the Illinois Natural History Survey for administrative and technical supervision.

A. H. Bogardus, a hunter and traveler who lived in Menard County, Illinois, in 1857, and who recorded his impressions in the book, Field, Cover and Trap Shooting, published in 1874, is quoted by Leopold (1931:194): "It is often supposed that it (the deer) likes best to range in the vast forests, but I believe that to be a mistake. Deer are most fond of country in which there are belts of timberland and brush interspersed with prairies and savannahs."

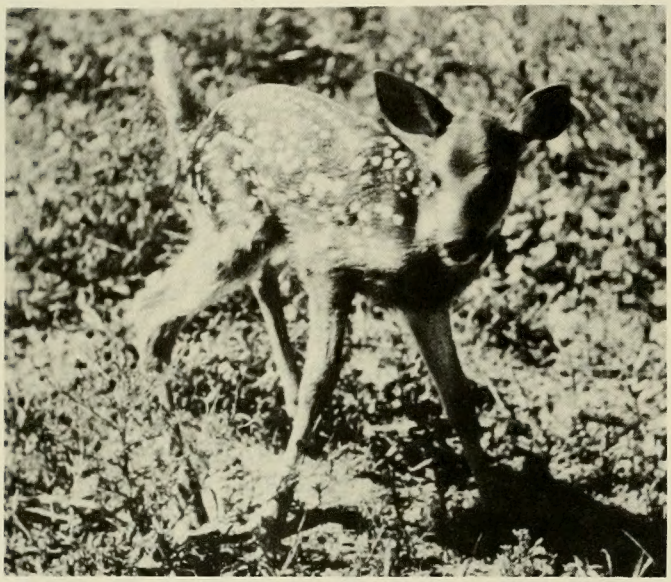


Fig. 2. -- Fawn, about 1 week old, on the Rock River range.

Faunistic records of early Illinois were often colorful but frequently they lacked preciseness. Nevertheless, they reflected something of the general trend of deer populations. Apparently deer numbers in Illinois did not change materially until after the settlement of the state had progressed somewhat. In 1821, John Woods (1822: 193), who had bought land in Edwards County 2 years before, observed that "Deer are not very numerous. I suppose, I have seen about 100, but never more than five or six together."

Some increase in the deer population seemed to be evident in the late 1830's. Jones (1838: 212) wrote, "Deer are more abundant than at the first settlement of the country. They increase, to a certain extent, with the population. The reason for this appears to be, that they find protection in the neighborhood of man from the beasts of prey that assail them in the wilderness."

Wood (1910:516) evidently believed that the peak of Illinois deer abundance was reached in the middle of the nineteenth century. He stated, in reference to the "part of the country" of which he wrote (east-central Illinois), "As the wolves were killed or driven off, the deer became more plentiful, reaching their greatest abundance between 1845 and 1855." The importance of predation as a limiting factor appears to have been overestimated by Wood, while the favorable effect of an increase in suitable habitat was overlooked. Present-day research on deer requirements has revealed that deer populations may be expected to increase whenever additional browse becomes available, as was the case in connection with many of the early lumbering and clearing operations.

It may be well to compare the time and cause of the population build-up among Illinois deer with the time and cause of build-ups of deer in Iowa, Wisconsin, and Indiana. Madson (1953:101) pointed to an increase of deer in many areas of Iowa in the early 1850's. At that time "heavily timbered tracts were being cleared, and deer habitat was improving." Swift (1946:8) cited "a Wisconsin newspaper item of 1853" which "stated that farmers along the Wisconsin-Illinois border, during a winter of deep snow, killed many deer with clubs to save their hay from being eaten by these starving animals." He noted that southern Wisconsin at the time of its settlement had a tremendous amount of forest "edge" and that therefore "conditions were highly ideal for deer." From Donald McLeod's History of Wiskonsan, written in 1846, Swift (1946:12) quoted this sentence: "But what seems very remarkable is that ever since the departure of the red man to the west of the Mississippi, the deer seem to have increased threefold." Barnes (1945:5) presented figures and dates that indicated Indiana saw its greatest deer population before 1878, probably about the middle of the nineteenth century. Like Swift (1946:17) and Madson (1953:101), he associated an increase in deer numbers with clearing or pioneer farming operations. "The small pioneer farm created more 'edge,' which temporarily increased the number of deer," Barnes wrote.

Available information, then, seems to indicate that deer populations of Illinois, Iowa, Indiana, and southern Wisconsin reached their peaks at about the same time, approximately the middle of the nineteenth century, and for the same reason, increases in habitat favorable to deer.

Initially the settlers and resident Indians killed deer for their own use. Subsequently, killing and selling of deer became a common practice. Woods (1822:194), who arrived in Edwards County,

Illinois, late in 1819, wrote, "I bought several [deer] in the winter, the greater part without their skins, at one dollar each, but one or two higher; one weighed more than 100 lb. weight. They generally weigh from 60 lb. to 100 lb. A good skin is worth fifty cents: their horns, though large, are of no value here." Of life in Pike County, Illinois, in 1831, Rebecca Burlend (1848:22) reported, "Mr. Oakes . . . . came to invite my husband to buy some venison, which he had killed with his rifle just before." Mrs. Burlend's husband bought "a quantity of nice venison at a halfpenny per pound." Jones (1838:213) described what appeared to be a somewhat wasteful exploitation: "Immense numbers of deer are killed every year by the hunters, who take them for the hams and skins alone, throwing away the rest of the carcase. Venison hams and hides are important articles of export. Fresh hams usually sell at from seventy-five cents to one dollar and fifty cents a pair, and when properly cured, are a delicious article of food."

In the early part of the nineteenth century, use of the deer resource had not progressed to the point where many herds were being greatly depleted; in fact, many herds were showing population increases. Some time prior to 1853, a tapering off of peak numbers must have been evident in the northern and northeastern parts of the state. In that year, the state legislature passed a law which prohibited the killing of deer between January 1 and July 20 in the following counties: Lake, McHenry, Boone, Winnebago, Ogle, De Kalb, Kane, Du Page, Cook, Will, Kendall, La Salle, Grundy, Stephenson, and Sangamon (Purple 1856:391).

It seems reasonable to believe that increasingly restrictive laws governing the hunting of deer reflected continued reduction in their numbers. In 1855 a closed season between January 15 and August 1 became effective throughout the state, except for designated counties, most of them in the lower parts of the Illinois and Embarrass river valleys and the southern one-fourth of the state (Purple 1856:391-2). This trend in law making suggests a noticeable falling off of the northern and central Illinois herds. Yet Bogardus was quoted by Leopold (1931:194) as stating that deer were "exceedingly plentiful" when, in 1857, he first arrived in Illinois (Menard County, one of the counties not included in the 1855 legislation).

The major reduction of the deer population which had been built up during the early days of settlement took place probably between 1850 and 1870. The human population in Illinois increased from 55,211 in 1820 to 1,300,251 in 1855 (Gerhard 1857:218). During the next 15 years, the population increased to 2,539,891. The tremendous increases in human population greatly accelerated the clearing of the wilderness that remained (Cole 1919:1). While openings created in the forests by the early pioneers provided the means for deer population growth, the industriousness of settlers and farmers of a later period increased the tempo of the clearing process to the point where suitable deer food and shelter were greatly curtailed. The destruction of deer habitat, together with the killing of deer for food and sport, and possibly for protection of crops, resulted eventually in a greatly reduced deer population.

During the middle of the nineteenth century, the deer herds in Iowa, southern Wisconsin, and Indiana were also undergoing reductions in numbers. In Iowa, deer were taken in large numbers by the settlers, and many were slaughtered shortly after the severe blizzard of 1856; with more intensive land use they were greatly reduced in numbers (Scott 1937:83). In southern Wisconsin, heavy hunting and "the tremendous human impact on the land" were thought by Swift (1946:16) to have been primary reasons for the decline in deer numbers there. In Indiana, the decrease in deer numbers was found by Barnes (1945:5) to have been the result of clearing the land for a predominantly agricultural state.

In 1873, the Illinois legislature by statute prohibited the killing of deer anywhere in the state between January 1 and August 15 (Hurd 1874:547). This statute seems to indicate that the southern as well as the northern herds had been greatly reduced in numbers by about 1870. By 1901, the deer population must have reached a very low level, for the legislature provided complete protection throughout the state for 5 years (Hurd 1901:963) and it has continued to give complete protection since that time.

Although it has not been established that deer were entirely extirpated from all sections of Illinois, it seems probable that "the last deer seen" progressed, by counties, from north to south. Leopold (1931:191, map) recorded no wild deer for the northern half of Illinois after 1874. His survey indicated that the last northern Illinois deer seen was in Ford County. It is possible, however, that deer existed in Illinois in the vicinity of the Kankakee River at a still later date. Barnes (1945:5) wrote, "Even as late as 1878, sixty-five of these animals [deer] were bagged in

a single day in the Kankakee region," in Indiana, and added that "Deer made their last stand [in Indiana] in the marshy expanse of the Kankakee and in the cypress swamps of Knox county. The last wild deer was seen near Red Cloud in Knox county in 1893."

Because the deer that lived in Knox County and along the Kankakee River in Indiana did not disappear until some time between 1878 and 1893, it is conceivable that, during that period, some of these animals wandered into Illinois and lived here for short periods of time.

For Champaign County, in east-central Illinois, Wood (1910:516) reported that a deer "was seen near Homer as late as 1880."

In southern Illinois, remnants of the original herds held on much longer. Cory (1912:62) told of a letter dated April 7, 1910, in which C. J. Boyd of Anna had written, "There are a few Deer in the hills in this county [Union] and in Alexander County." Supporting this information is a statement by Aldo Leopold, in an unpublished report of May 1, 1929, to the Game Restoration Committee, Sporting Arms and Ammunition Manufacturers' Institute, that Ed. C. Karraker of Jonesboro said "that wild deer of native stock did not disappear from Union County until about 1910." No data postdating these records of wild deer of native stock in southern Illinois have been uncovered; therefore, it is believed that the original Illinois white-tailed deer herds probably were exterminated shortly thereafter.

Repopulation of Deer

The white-tailed deer may have returned to the wild in northern Illinois through occasional escapes from a herd maintained near Polo by the late Judge John D. Campbell. It is not known when or where Judge Campbell obtained these deer. It seems reasonable to conclude that the Judge was maintaining a herd as early as the 1860's. Miss Anna Parmalee, a resident of Polo, who was 96 when interviewed on March 21, 1952, recalled "seeing Judge Campbell's deer when I was a little girl." Attorney Harry Typer of Polo revealed, in an interview on the same day, that he, as a boy of 14, took care of Judge Campbell's herd of deer in 1882. Miss Parmalee and another elderly Polo resident, E. M. Clinton, claimed that deer occasionally escaped from the Judge's pen. Typer, however, did not believe that escapes occurred, and observed that "The deer were kept by the old Judge until his death in 1910, at which time the herd, then numbering 20 to 25 animals, was turned loose on the Scott McMillan farm," located about 5 miles northeast of Polo in Ogle County. These deer were thought to have survived and increased their numbers in the wild.

Another herd, fig. 3, which may have contributed to the repopulation of parts of northern Illinois with deer was kept by the late George Stevens of Kishwaukee, Illinois. Harry Stevens, a son, interviewed on March 18, 1952, reported that "In the summer of 1896 or 1897, Mr. W. A. Rothwell bought a doe fawn from a hotel keeper in Eland, Wisconsin. Mr. Rothwell gave this animal to my father and he kept it in a pen on his farm 1 mile west of Kishwaukee. It was given the name Fanny. In the fall of 1898, my father secured a buck from Judge Campbell of Polo. This buck, Sam, and Fanny were successful in raising a number of fawns in the ensuing years. Occasionally one of the penned animals escaped; the entire herd, 10 or 12 at the time, was lost in the spring of about 1903, when a tornado felled trees on the pen, letting the deer out." These observations were substantiated by Lester R. Rothwell, a brother-in-law of the late George Stevens in a letter dated March 28, 1952. In referring to the herd following its escape from the Stevens pen, he stated, "The first year they stayed in F. C. Johnson's orchard; then went to the woods along Rock River; later along the Kishwaukee."

From all accounts it seems apparent that these two released herds contributed to the repopulation of parts of northern Illinois with wild deer early in the twentieth century. Also, it is conceivable that an occasional deer may have wandered into Illinois from Wisconsin at that time.

A release worthy of record, because of its location, was made at the Savanna Ordinance Depot in Carroll County, northern Illinois, at some time in the middle 1930's. Sergeant Albert Bingham (retired) stated, in an interview on May 22, 1952, that in about 1936 he had released there a buck and a doe obtained from the Mount Vernon Game Farm. Later he released a doe obtained from the Springfield Game Farm in 1937 and a buck obtained from the same place in 1938. Sergeant Bingham indicated that fawns were produced by these deer. His releases are thought to have been successful, as, during the census of 1950-51, a population of about 100 deer was estimated for Carroll County.

The circumstances and dates of the return of wild deer to southern Illinois are not clear. Bennitt & Nagel (1937:80) reported an estimated

Fig. 3. -- Reproduction of photograph, now faded, taken of doe, Fanny, and buck, Sam, probably in the late 1890's. These deer and their offspring, two of which are shown here, were owned by the late George Stevens of Kishwaukee. They are believed to have provided the nucleus for a herd that contributed to the repopulation of the Rock River deer range in northern Illinois.

population of 15 and 17 wild deer, respectively, in 1925 and 1926 in Ste. Genevieve County, Missouri, across the Mississippi River from Randolph County, Illinois. A legal kill of 18 deer was reported for Ste. Genevieve County by hunters during four open seasons, 1933-1936. There was no open season in the period 1925-1930 (Bennitt & Nagel 1937:79). Some of these Missouri deer, possibly stimulated by hunting pressure, may have made their way across the river into such Illinois counties as Union, Jackson, and Randolph. The late Ernest L. Mills, in an unpublished report written in 1935 while he was with the Civilian Conservation Corps in southern Illinois, recorded that a friend of one of the men he interviewed had seen a deer in Union County about 1932; in the opinion of the observer, the deer had come in from Missouri.

The deliberate release of deer in southern Illinois was begun by the Illinois Department of Conservation in the 1930's. So far as is known, the first release in southern Illinois was that made on the Horseshoe Lake Game Refuge in 1933 and reported by Leopold, Sowls, & Spencer (1947:166). One buck and three does were released on this occasion.

The next recorded southern Illinois release was made by the United States Forest Service in the Shawnee National Forest. In this instance, five deer, two bucks and three does, were turned out near Belle Smith Springs in Pope County in December, 1935. These animals were sent from Augusta, Michigan, by H. D. Ruhl of the Michigan Department of Conservation. In addition, records reveal, four deer, sex unknown, were obtained in March, 1936, from the Mount Vernon Game Farm

Fig. 4. -- Setting box-type trap used to catch deer on the Rock River range in northern Illinois.

Fig. 5. -- Transfer box into which captured deer is driven from trap.

Fig. 6. -- Weighing deer in transfer box.

Fig. 7. -- Tagging deer in transfer box.

Fig. 8. -- Doe breaking for freedom after having been trucked in transfer case from Rock River range and released in new environment.

and released in the Union County State Forest near Jonesboro.

In a letter dated April 21, 1953, Conrad W. Carlson, then acting supervisor of the Shawnee National Forest, wrote, "As to the success of the early plantings, it appears that deer were observed on rare occasions beginning in 1936. The animals were listed as rare in our annual reports from 1936-41."

No other releases are known to have been made until the winter of 1942-43, when the removal, by live trapping, of deer from the island of the Horseshoe Lake Game Refuge to various southern and central Illinois counties was initiated. Therefore, it appears that the early development of the present southern Illinois herds came about principally from the three releases described above, and possibly in addition from an ingress of wild deer from Missouri.

The program of live trapping and redistributing deer, undertaken by the Department of Conservation during the winter of 1942-43, has contributed greatly to the present wide distribution of deer in Illinois, figs. 4, 5, 6, 7, 8. From the fall of 1942 to the spring of 1953, approximately 439 deer were trapped on the island of the Horseshoe Lake Game Refuge and about 433 were redistributed to various Illinois counties, table 1. From the fall of 1946 to the spring of 1953, 158 deer were trapped on the Rock River range and 153 were relocated, principally in southern Illinois, table 2. In addition, in the winter of 1952, 11 deer were removed from the Springfield Game Farm and released in three central Illinois counties. Thus, about 600 Illinois deer have been introduced into new surroundings through redistribution.

Records of the Illinois Department of Conservation on the redistribution of deer prior to 1947 have been lost. C. E. Laughery, who was in charge of deer trapping at the Horseshoe Lake Game Refuge from the fall of 1942 to the spring of 1944, reported that releases were made in many counties of the state in that period. Complete records, most of them summarized in tables 3 and 4, were maintained from the fall of 1947 to the spring of 1953. During that time, 347 deer from all sources were released in 18 counties, fig. 9.

In addition to animals represented by the redistribution records listed in tables 3 and 4, two deer that were obtained along the Rock River near Byron were released in Cook County in the spring of 1950. As fawns, these animals had been injured by farming operations, nursed to health by farmers, and subsequently turned over to the Department of Conservation for disposition. Also, 11 deer, trapped on the Springfield Game Farm in February and March of 1952, were released in four counties as follows: 2 in Cook, 3 in Clark, 3 in Piatt, and 3 in Sangamon.

There probably has been some recent migration into Illinois from adjacent states. Although verified observations are lacking, this influx may have taken place from Wisconsin, Iowa, Missouri, and Indiana.

Table 1. - Summary of deer trapping on the island of the Horseshoe Lake Game Refuge, Alexander County, Illinois, 1942-1953. (Weight in pounds.)

Year	Total Catch	Average Weight	Trapping Losses
1942-43	50*	--	--
1943-44	75*	--	--
1944-45	62	--	--
1945-46	24	--	--
1946-47	25	--	--
1947-48	59	96.2	1
1948-49	9	--	0
1949-50	0	--	0
1950-51	72	103.8	4
1951-52	46	107.6	1
1952-53	17	113.9	0
Total	439		6

* Estimated number.

Table 2. - Summary of deer trapping on the Rock River range in Ogle and Winnebago counties, Illinois, 1946-1953. (Weight in pounds.)

Year	Bucks	Does	Sex Ratio	Total Catch	Average Weight	Trapping Losses
1946-47	8	7	1:0.88	15	--	0
1947-48	19	23	1:1.21	42	96.0	0
1948-49	26	21	1:0.81	47	84.3	4
1949-50	5	8	1:1.60	13	72.7	0
1950-51	20	21	1:1.05	41	84.9	1
1951-52	0	0	--	--	--	--
1952-53	0	0	--	--	--	--
Total	78	80	1:1.03	158	--	5

Table 3. - Number of deer trapped on the Rock River range in Ogle and Winnebago counties, Illinois, and relocated by counties, 1947-1951.

County	1947-48	1948-49	1949-50	1950-51	Total
Carroll	--	2	--	--	2
Gallatin	--	12	7	--	19
Hardin	5	--	--	6	11
Jo Daviess	2	--	--	--	2
Lee	4	3	--	--	7
Perry	--	--	6	--	6
Pope	31	26	--	34	91
Total	42	43	13	40	138

Table 4. - Number of deer trapped on the island of the Horseshoe Lake Game Refuge, Alexander County, Illinois, and relocated by counties, 1947-1953.

County	1947-48	1948-49	1949-50	1950-51	1951-52	1952-53	Total
Alexander	--	--	--	13	--	7	20
Fayette	--	--	--	--	5	--	5
Gallatin	7	--	--	28	9	4	48
Hamilton	--	--	--	5	14	--	19
Hardin	14	--	--	--	--	--	14
Jackson	--	9	--	--	--	--	9
Massac	--	--	--	20	4	6	30
Perry	--	--	--	--	5	--	5
Pope	33	--	--	--	--	--	33
Saline	--	--	--	--	8	--	8
Union	4	--	--	1	--	--	5
Total	58	9	0	67	45	17	196

Geographic Distribution

That the Illinois area occupied by deer has been greatly expanded in recent years is denoted by the increasing numbers of counties in which the animals have been found. Reports of conservation officers for 1947 indicate that in that year deer were to be found in 45 of the 102 counties of the state. Reports from the same source show that by 1949 deer were present in 62 counties, by 1950, in 68 counties. Data obtained following the last conservation officer report, that of 1950, indicate that deer were present in at least 74 counties early in 1953, fig. 10. To a large group of counties in east-central Illinois, deer have not returned. This group is in the intensively farmed black prairie region, and very little habitat which might be considered suitable for deer exists in this area.

Although deer are widely distributed in Illinois, the reader should not assume that all the acceptable deer ranges in the state are fully occupied, fig. 11. In northern Illinois, only some portions of the Rock River range, fig. 12, which is located along the Rock and Kishwaukee rivers and their tributaries in De Kalb, Lee, Ogle, and Winnebago counties, are carrying a capacity population of deer. While most suitable ranges in the state contain some deer, the populations of many of these ranges can increase severalfold before carrying capacities are reached.

For example, much of the land not suitable for cultivation along some of the larger rivers in Illinois appears capable of supporting much larger deer herds than are now present there. Of major importance are such areas as the Mississippi River bluffs in Joe Daviess, Carroll, and Whiteside counties, the riverbreak country along the Illinois River in Bureau, Putnam, and Marshall counties, and the Kaskaskia River bottoms in Fayette, Clinton, and Washington counties.

By far the most promising deer range in Illinois is to be found in and adjacent to the Shawnee National Forest in southern Illinois, fig. 12. Nine counties are represented in the Shawnee's 1,500,000 acres of forest and potential forest land. Much of this land is primarily suitable only for growing trees, because the fertility of the soil is low and the slopes are steep. The deer herds

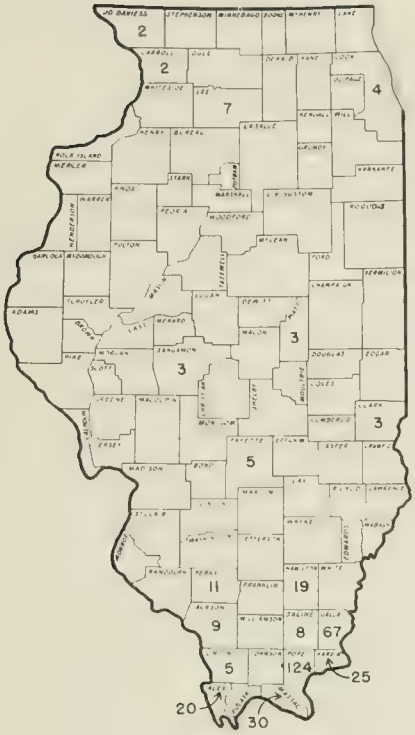


Fig. 9. -- Number of deer (represented by numerals) released in counties of Illinois by the Department of Conservation, 1947-1953.

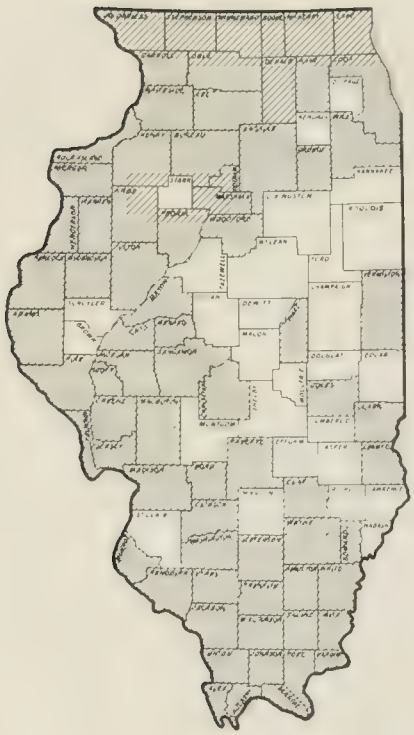


Fig. 10. -- Illinois counties in which one or more deer were reported to be present in early 1953 (represented by hatching).

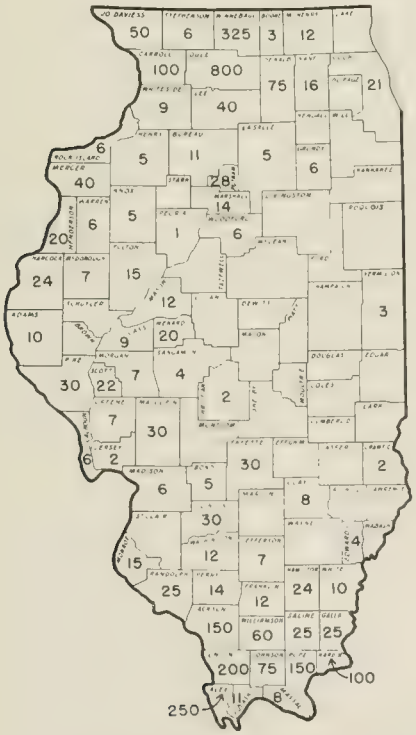


Fig. 11. -- Number of deer (represented by numerals) in Illinois counties, winter of 1950-51. (Most of data from conservation officers.)

Fig. 12. -- Principal Illinois deer ranges and areas of concentration (Severson and Funderburg estates and Horseshoe Lake Game Refuge).

should be favored by the sustained yield policies of forest management in effect there.

Studies made in 1949 and 1950 in eight counties in the Shawnee National Forest and one adjacent county show that deer were present on only about 203,000 of the 439,087-acre area examined, table 5. Resident landowners provided considerable information in drawing the line between occupied and unoccupied ranges. In addition, foresters, conservation officers, and interested sportsmen contributed helpful sight records.

From data given in table 5 can be calculated the proportion of each of several cover types occupied by deer: 43.5 per cent of the upland hardwoods, 49.8 per cent of the bottomland mixed hardwoods, and 87.8 per cent of the pin oak flats. As the early deer releases were made indiscriminately in these three cover types, it is thought that the greater use of the pin oak flats showed that deer preferred this type. The upland hardwoods, which comprised the largest land area by far, appeared to be least desirable. It is believed that most of the unoccupied area is capable of supporting deer herds. Some of the deer removed from areas in which the animals were too numerous or destructive were released in parts of this unoccupied area during the winters of 1951-52 and 1952-53.

Populations

An effort to assemble population data on the various deer herds of Illinois was begun in the spring of 1947. Reports received from conservation officers at that time indicated that deer were showing a general increase and appearing in counties not occupied by them in the recent past.

Deer population estimates were made for the winters of 1949-50 and 1950-51. These were based on data obtained from three sources: (1) conservation officers, (2) aerial censuses of the Rock River range, and (3) deer drives on the island of the Horseshoe Lake Game Refuge. The data indicated state-wide populations of about 2,550 in 1949-50 and more than 3,075 in 1950-51. The distribution of the 1950-51 deer populations by counties is shown in fig. 11. Location of the principal deer ranges is shown in fig. 12.

Reports from conservation officers indicate the nature of the population trend during the 1949-1951 period, table 6. The number of counties for which increased deer populations were reported in both 1949-50 and 1950-51 was far greater than the number for which reduced populations were reported. In addition, deer were reported present in six more counties in the winter of 1950-51 than in the previous winter.

Population on the Rock River Range.--The earliest information on the deer population that occupied the Rock River range, fig. 12, following the escapes and releases mentioned previously, was obtained from Dr. David H. Thompson of the Forest Preserve District of Cook County on August 20, 1953. Dr. Thompson reported that, while he was conducting a full-time study of the Rock River from Sterling to the mouth of the Kishwaukee River in 1925 and 1926 for the Illinois Natural History Survey, he learned from the local people much about the number of deer in the area. After noting this type of information for 2 years, he estimated a population of about 200 deer for Ogle and Winnebago counties between Dixon and Rockford.

Deer on the Rock River range were censused from the air in February of 1947, 1949, and 1950, and in December of 1950. Swears (1948:12) described the initial survey, which was conducted in Ogle and Winnebago counties by Willet N. Wandell of the Illinois Natural History Survey and William L. Preno of the Illinois Department of Conservation. Aerial photographs were taken by Wandell on this survey, fig. 1 and back cover.

Estimates based on a complete aerial survey of brushy and wooded areas in which deer normally ranged proved to be of greater accuracy than estimates obtained by sampling the area along predetermined flight strips. Figures derived from the strip census were found unreliable because this type of census did not eliminate the bias introduced by the extremely uneven distribution of deer on the Rock River range in winter.

In an unpublished report, Wandell stated that the area censused during the first survey, in February, 1947, comprised 8,110 acres of woodland in close proximity to the Rock River in Ogle and Winnebago counties. Observations revealed a total of 655 deer in the censused area. Wandell estimated that three of every four deer in the censused area were seen and recorded and calculated the population for the censused area as 872. He estimated that 67 per cent of the deer range in these two counties had been surveyed, and he apparently assumed that the deer density in the uncensused area was equal to that in the censused area. Using the data then available, he calculated that the deer population of Ogle and Winnebago counties was 1,295. The writer believes that this initial estimate of the population was too high, for subsequent surveys

Table 5. - Estimated acreages of woodland occupied and unoccupied by deer in nine southern Illinois counties, 1949-50.*

County	Bottomland Mixed Hardwoods		Pin Oak Flats		Upland Hardwoods	
	Occupied	Unoccupied	Occupied	Unoccupied	Occupied	Unoccupied
Alexander	18,208	--	3,813	--	--	37,373
Gallatin	1,553	21,305	40	327	4,813	9,709
Hardin	3,296	--	--	--	26,382	--
Jackson	6,286	14,668	1,806	--	10,571	51,227
Johnson	9,124	--	--	--	27,549	--
Massac	3,283	8,293	847	963	779	11,180
Pope	5,959	--	1,310	--	62,637	--
Pulaski	--	15,738	--	--	--	4,603
Union	11,733	--	1,460	--	1,609	60,643
Total	59,442	60,004	9,276	1,290	134,340	174,735

*The cover type classifications used in this table are modifications of classifications used in a forestry publication (Anonymous 1950). The new classifications were adopted after consultation with personnel of the University of Illinois Department of Forestry.

Bottomland mixed hardwoods. -- Chief species: cottonwood, sycamore, ash, sweetgum, soft maple, elm, willow, hackberry, box elder, honey locust, water locust, pecan; white, cherry bark, and water oaks. Sites: varies from well-drained alluvial lands to well-drained primary and secondary bottomland.

Pin oak flats. -- Chief species: pin oak, soft maple, elm, hickories, and sweetgum. Frequently stands are nearly pure pin oak. Sites: poorly drained level lands.

Upland hardwoods. -- Chief species: red, white, and black oaks, hickories, maples, yellow poplar, beech, ash, blackgum, and sweetgum. Sites: hilly regions, coves, upland claypan areas, and stream margins.

Table 6. - Deer population and distribution trends in Illinois, as reported by conservation officers in counties of the state, 1949-1951.

Year	Counties Reporting	Counties Reporting Deer	Counties Reporting Deer Increases	Counties Reporting Deer Decreases
1949-50	102	62	35	3
1950-51	102	68	32	2

showed that the deer density in the outlying areas was much lower than that found in the vicinity of the Rock River.

The pattern of subsequent censuses was essentially the same as that of the first, but, as the area covered was much more extensive, the results are not thought suitable for comparison. The subsequent surveys included range in De Kalb and Lee counties as well as in Ogle and Winnebago counties.

In each of the censuses made in February, 1949 and 1950, and December, 1950, the airplane was flown in overlapping circles, 200 to 350 feet above individual woodlots, until it was felt that all the deer below had been seen and recorded, table 7. These surveys were not undertaken until the snow depth exceeded 3 inches, because old deer beds in snow of less depth could not be readily distinguished from deer actually bedded down.

Both two-place and four-place Piper Cub airplanes were used in these surveys. The slower-flying two-place plane permitted more intensive scanning of the ground; thus, this type of plane was thought more suitable than the faster four-place model.

An observer performed the censusing duties; the pilot aided in locating deer, as opportunities permitted.

The flying time required to complete each of these surveys varied between 12 and 18 hours, depending on the amount of range flown. As may be seen in table 7, the range surveyed varied between 63 and 83 square miles, but virtually all the deer counted in the three surveys were seen in the 63 square miles flown in February, 1949, and December, 1950.

Figures in the last column in table 7 were arrived at by assuming that only 66 per cent of the deer in the region were seen from the air. This correction factor was derived, during the February, 1950, census, by comparing counts made from the air with counts made from manpower drives in four widely scattered woodlots. Sixty deer were tallied from the air, whereas 91 were counted in the drives. The accuracy of the figures obtained from these small samples was questioned; however, since no other data were available from which to derive a

Table 7. - Data from aerial surveys of deer on the Rock River range, principally in Ogle and Winnebago counties, Illinois, 1949 and 1950.

Date	Range Flown, Square Miles	Visibility	Deer Seen	Estimated Population
February, 1949	63	Good	661	1,002
February, 1950	83	Fair	559	847
December, 1950	63	Good	656	994

correction factor for the Rock River range, the calculated correction factor, 66 per cent, was used.

It is interesting to note that the estimated numbers in the herds varied by only eight in the 2 years when visibility was rated "good." In February of 1950, when the visibility was considered only "fair," the estimated number was about 150 short of the estimated number in the other years. The low count was thought to have reflected a shortcoming of the aerial census, rather than an actual reduction in population, for the writer, while conducting field studies, did not observe a population decline between the fall of 1948 and the spring of 1951. Nor did landowners and conservation officers in this area who were interviewed believe that the deer population had changed materially during this period.

Population on the Horseshoe Lake Game Refuge.—The earliest information available concerning the deer population on the island of the Horseshoe Lake Game Refuge, fig. 12, is that supplied by Leopold, Sowls, & Spencer (1947: 166), who stated that the population had increased from an original planting of 1 buck and 3 does in 1933 to a total of 250 deer by 1944. The herd was reported to have been reduced by trapping until about 150 were present at the outset of the winter of 1947-48 (Swears 1948:15).

More information on the status of the herd on the island of the Horseshoe Lake Game Refuge was brought to light in 1950. A drive on April 22 of that year revealed 168 deer. The next census, December 9, 1950, produced a count of 195 deer. Nineteen animals had been removed during the fall of 1950 by live trapping; thus, the total population in early fall, 1950, is estimated to have been 214. This represented a 27.4 per cent increase over the spring population.

The area per deer on the island in the spring of 1950 was approximately 7.1 acres; by early fall the area per deer had been reduced to approximately 5.6 acres. These figures represent population densities considered high for deer range of average quality. The gravity of the population problem on the island became especially apparent when it was realized that about 750 of the approximately 1,200 acres there were being used to grow field crops, which in themselves were not desirable deer foods.

The effects of a deer population on its range were discussed by O'Roke & Hamerstrom (1948) in their paper on the George Reserve deer herd. This southern Michigan herd had its beginning in March, 1928, when four does and two bucks were released in the enclosure on the reserve. Approximately 1,200 acres in size, the reserve consisted of about 46 per cent grassland, 43 per cent woody vegetation, and 11 per cent marsh and bog.

"In the fall of 1933 it became apparent that the deer had increased phenomenally and that vegetation was being drastically overused," wrote O'Roke & Hamerstrom (1948:79). The first deer drive and count on the area indicated that a deer population of about 160 inhabited the area in the early part of the winter of 1933-34. The area per deer for this population was approximately 7.5 acres.

In the winters beginning with 1933-34 and ending with 1940-41, the early winter herds fluctuated between 112 and 210 deer. O'Roke & Hamerstrom (1948:85) related that "There has been a noticeable improvement in the under-story since the herd was cut back to an average of about 55 [per section] in the winter of 1941-42." The area per deer for this population was about 11.6 acres.

Writing in 1947, O'Roke & Hamerstrom (1948: 86) stated that "there has been some recovery during the last four or five years, ... but the invasion of brush and trees into the old fields is still almost at a standstill." The deer density had declined until, early in the winter of 1946-47, the area per deer was about 16.2 acres.

Sex and Age Ratios

Data on the sex ratios of deer on the Rock River range were obtained from three sources: (1) live trapping, (2) fatality counts, and (3) field observations, table 8. In 4 years of trapping, 78

Table 8. - Sex ratios of deer trapped, found dead, or observed in the field on the Rock River range, principally in Ogle and Winnebago counties, Illinois, 1947-1951.

Period	Bucks	Does	Buck: Doe Ratio	Source of Data
1947-1951	78	80	1:1.03	Live trapping
1948-1951	98	99	1:1.01	Fatality counts
1948-1951	152	146	1:0.96	Field observations
Total	328	325	1:0.99	—

Table 9. - Sex ratios of deer trapped on the island of the Horseshoe Lake Game Refuge, Alexander County, Illinois, 1946 through spring of 1953.

Year	Bucks	Does	Buck: Doe Ratio
1946-47	16	9	1:0.56
1947-48	32	26	1:0.81
1948-49	4	5	1:1.25
1950-51	15	57	1:3.80
1951-52	19	27	1:1.42
1952-53	4	13	1:3.25
Total	90	137	1:1.52

Table 10. - Data on sex and age classifications of 244 deer seen on the Rock River range, principally in Ogle and Winnebago counties, Illinois, 1950. The doe to fawn ratio was 1:0.916.

Classification	Number Seen	Per Cent of Total Seen
Adult or yearling bucks	85	34.8
Adult or yearling does	83	34.0
Fawns	76	31.2
Total	244	100.0

bucks and 80 does were caught; of the fatalities of all kinds recorded in this area, 98 were among bucks and 99 were among does; and, of deer observed in the field, 152 were bucks and 146 were does.

The computed sex ratio for the 328 bucks and 325 does listed above is 1 buck to 0.991 doe. C. W. Severinghaus of the New York State Conservation Department, in a letter dated September 21, 1951, indicated that the buck-to-doe ratio of 11,065 fawns, less than 9 months of age, killed by non-selective agents in New York was 1:0.960.

Sex ratio data for the deer trapped on the island of the Horseshoe Lake Game Refuge were meager and they were inconsistent from year to year; nevertheless, it is thought that they are worthy of record, table 9. In the first 2 years for which records are available, bucks outnumbered does, but in the last three winters the number of does caught was considerably greater than the number of bucks taken. Perhaps the excessively high deer populations in the more recent years resulted in pressures which caused more bucks than does to leave the island. Observations on the Rock River range, table 8, do not indicate that the trapping technique, as used there, was selective for does.

Deer fatalities, from the fall of 1948 to the spring of 1951, provided some data on the sex ratios of deer in widely scattered sections of southern Illinois. Of 35 deer that died from a variety of causes, but most of them as a result of highway accidents, 20 were bucks and 15 were does, a 1:0.75 ratio. The losses occurred in 10 southern Illinois counties, chiefly in and near the Shawnee National Forest. It is realized this is a small sample for so large an area, and record is made of it here largely for addition to such future data as may be collected.

Data on the age ratios of deer were obtained in the Rock River range from field observations in the summer and fall of 1950; 244 deer were seen clearly enough to be classified as to sex and age, table 10. The relative length of muzzle was used to distinguish fawns from older deer.

Of the adult and yearling deer, 85 were bucks and 83 were does; the buck-to-doe ratio was 1:0.976. The doe-to-fawn ratio was 1:0.916.

The aerial census in December, 1950, indicated a deer population on the Rock River range of 994; thus, the 244 identified deer made up a sample of 24.5 per cent of the estimated total population. It was felt that this sample gave an accurate index of the doe-to-fawn ratio and suggested good productivity in this area for 1950.

Movements

Seasonal movements of the deer on the Rock River range were evident in spring and fall of

Table 11. - Recovery data, 1948-1951, from 335 tagged deer released in Illinois since about 1947. All recoveries were from releases made in southern Illinois.

Tag No.	Sex	Release Date	Recovery Date	Miles From Recovery to Release Site	Cause of Death
28	?	Unknown	1-15-48	?	?
75	M	2-19-48	2- 2-49	98	Shot
633,634	M	2-19-49	4-10-49	6	Fence
577,578	F	2- 4-49	4-18-49	8	Shot
510	F	2-15-48	5-15-49	28	Car
599,600	M	2- 7-49	9-29-49	6	?
502	F	1-31-48	11-19-49	1½	Shot
303	M	2-14-49	5-18-50	8	Motorcycle
625,626	M	2-15-49	11-11-50	4	?
731,732	M	2-14-51	2-18-51	25	Hurt in transit

the years of this study. During April, in 1950 and 1951, a moderate shifting outward was noted in those herds that wintered in close proximity to the Rock River. Small groups or single deer appeared in wooded creek bottoms and in large upland woodlots as much as 6 or 7 miles from the river, in places where none had been present in winter. The animals remained in these outlying habitats throughout the remainder of the spring and summer. In late fall, the spring movement was reversed when the adult deer and their offspring moved back to winter ranges along the river. This population build-up along the river in fall resulted in herds ranging in size up to more than 100 individuals. Herds of 15 to 35 were common.

Some information on the movements of deer following their release on unfamiliar range was obtained. Of 335 tagged deer which have been released over the state since about 1947, recovery data have been obtained on only 10, table 11. All of these recoveries were from releases made in southern Illinois counties. Three of these 10 deer had been shot.

It will be noted that the straight line distance from the release site to the point where the tag was recovered varied from 1.5 to 98 miles; the average was 20.5 miles. The buck that migrated 98 miles had been released almost a year before the date of tag recovery. Length of time from release of deer to recovery of tag seemed to have little bearing on the distance traveled by the deer. Four tagged deer recovered more than a year after their releases averaged only 10.5 miles; the maximum for these deer was 28 miles and the minimum 1.5 miles.

Table 12. - Fatality records for deer in Illinois, 1948-1951.

Cause of Fatality	Fatalities in Rock River Range, January, 1948-May, 1951		Fatalities in Illinois, Exclusive of Rock River Range, September, 1948-March, 1951	
	Number	Per Cent	Number	Per Cent
Highway accidents	135	50.2	43	56.6
Poaching	45	16.7	3	3.95
Dogs	19	7.1	4	5.3
Fence entanglements	13	4.8	3	3.95
Farming operations	12	4.5	0	0.0
Drowning	7	2.6	2	2.6
Live trapping	5	1.9	5	6.6
Trains	2	0.7	8	10.5
Buck fights	2	0.7	0	0.0
Malnutrition	2	0.7	1	1.3
Unknown	27	10.1	7	9.2
Total	269	100.0	76	100.0

Fig. 13. -- Remains of a deer that showed signs of having succumbed to a pack of domestic dogs on the Rock River range.

Fig. 14. -- Two bucks on the Rock River range that died after having locked horns in a fight that took place during the breeding season.

Mortality

Recent censuses on the Rock River range have pointed to a stable resident deer population there. Productivity has been shown to be good; no confirmed report of emigration beyond the limits of the range has been brought to light. The relatively stable population on this range has largely been a consequence of a mortality that balanced the productivity.

Many data on deer mortality were furnished by conservation officers, in particular, Officer Paul Beebe of Forreston, who provided most of the records for the Rock River range. Other information was obtained through direct observation in the field and from resident farmers.

Of the known causes of mortality among deer in Illinois, highway accidents were the ones that most frequently came to attention, table 12. Approximately half of the fatalities recorded were attributed to motor vehicles. Deaths recorded as resulting from poaching were 15 times as many on the Rock River range as elsewhere in the state. On this range, high population densities were present over a larger area than elsewhere, and the deer were more readily accessible to poachers. Poaching was undoubtedly a much more frequent mortality cause than was indicated by the records. Poachers usually took precautions to conceal evidence of their activities; therefore, such losses frequently went unnoticed. Losses resulting from attacks by dogs, fig. 13, were also thought to have been higher than indicated by the figures, because old evidence of dog kills was not readily identified, and cause of death was listed as unknown, when any doubt existed. A very small loss occurred from antler locking when bucks fought during the breeding season, fig. 14.

Condition of Herds

During the period of this investigation, the condition of the deer throughout Illinois appeared excellent, except for those animals inhabiting the most heavily populated area on the Rock River range and the island of the Horseshoe Lake Game Refuge.

The degree to which food plants have been browsed may be used as an indicator of the state of balance existing between deer and their food supply. If the deer population does not exceed its food supply, such marked evidence of close feeding as a browse line, at the greatest height to which the deer reach when standing on all fours, will not be easily discerned on the more desirable food plants.

On the Rock River range, only one small area, consisting of the Harry Severson and the Hugh Funderburg estates, fig. 12, exhibited from the beginning of this study a marked browse line, fig. 15, indicative of restricted food resources. These adjoining estates, encompassing about 4 square miles of forest and agricultural range, are located about 7 miles southwest of Rockford.

Although domestic livestock has not been pastured in the woods or brushland on the area since about 1941, palatable trees and shrubs within reach of deer have suffered severely from overbrowsing, figs. 16 and 17. This area has, for many years, supported the highest deer concentration in northern Illinois.

Nearly 18 years ago, the late Aldo Leopold noted the high level of the deer population in the Rockford area. In an unpublished report dated October 15, 1936, he wrote as follows to Harry D. Colman, then owner of the land now known as the Funderburg estate: "There are already plenty of deer for pleasure purposes: I saw 15 and 25 per day with no effort to keep quiet." He noted that "Mr. Severson saw forty deer at one time two years ago."

Although Leopold considered the deer population very high, he saw no evidence of overbrowsing of winter food plants. He warned, however, that a further increase in the numbers of deer would endanger both the range and the herd. He based this belief partly on the assumption that there was no opportunity for geographic spread.

Following an inspection about a year later, Leopold wrote to Colman in an unpublished report dated September 21, 1937, that he experienced "the distinct impression that browsing is heavier

Fig. 15. -- Browse line on deciduous trees in an area heavily populated by deer of the Rock River range.

Fig. 16. -- Severe deer damage to white pine on the Rock River range.

Fig. 17. -- Another example of severe deer damage to white pine on the Rock River range.

than a year ago," and he advised that "The Rockford range shows all the preliminary symptoms of impending overpopulation."

Developments taking place since Leopold's surveys reveal that he underestimated the possibilities of the deer for expansion into unoccupied parts of the Rock River range. Nonetheless, his foresight concerning deterioration of the range near Rockford proved correct.

Cheatum (1949:19, 22) demonstrated a correlation between weight loss in deer and fat reduction in the marrow of the femur of the animals; he observed that a serious stage of malnutrition was indicated when less than 25 per cent by fresh weight of the femur marrow was composed of fat. He stated that some deer have been found dead with 20 to 25 per cent fat in their femur marrow, and he suggested that death usually results when the marrow fat is depleted below 15 or 20 per cent.

In an effort to evaluate the extent of malnutrition among deer on the Severson and Funderburg estates, the author collected marrow from the femur bones of six deer found dead in February and May of 1950, table 13. The results of fat analyses by the Department of Veterinary Pathology and Hygiene at the University of Illinois showed that the percentage of fat by weight in specimens 1, 2, and 6 was below the minimum survival level as indicated by Cheatum (1949:22) for most deer. The value found for specimen 6 is considered questionable because warm weather immediately prior to discovery of the carcass may have caused a loss of fat through the porous femur bone. These specimens were taken from animals that, judged by Cheatum's criteria, were in an advanced stage of malnutrition at the time of death; specimen 4 was taken from a deer in a serious stage of malnutrition at the time of death.

Table 13. - Fat analyses of marrow from the femurs of deer found dead on the Rock River range, Ogle and Winnebago counties, Illinois, winter and spring, 1950.

Specimen No.	Date Carcass Found	Per Cent of Fat by Weight, in Marrow
1	2-12-50	9.1
2	2-25-50	13.4
3	5-19-50	43.5
4	5-19-50	23.8
5	5-19-50	49.5
6	5-31-50	8.3

The proportion of fat remaining in specimens 3 and 5 indicated that they were taken from deer that died from causes other than malnutrition.

Deer in good physical condition undergo pelage changes at rather uniform times of the year. In West Virginia, the change from the winter to the summer coats normally begins in early March and continues into May (De Garmo et al. 1950:63). The change to the reddish summer coat is retarded in unhealthy deer. It is thought that the normal pelage changes on deer in Illinois occur at approximately the same times as on deer in West Virginia, as weather conditions and latitudes of the two states are comparable. On the Severson and Funderburg estates, many deer still had partial winter coats as late as June 7 in 1950. Complete winter pelage was seen on a doe on June 15 and on a buck on June 19 of the same year.

The only other Illinois herd known to have been in excess of the carrying capacity of its environment, while this study was in progress, was that on the island of the Horseshoe Lake Game Refuge. A browse line was extremely obvious on the island, and the reproduction of acceptable woody plants was greatly retarded. Sassafras, Sassafras albidum, and several species of dogwoods, Cornus spp., were eliminated so far as availibility to the deer was concerned. The sassafras trees that remained were large and their branches were far out of reach of the deer. In other parts of Alexander County, dogwoods and sassafras appeared to be the woody plants most sought after by deer. Trumpetcreeper, Campsis radicans, which furnished some food for deer on the island of the Horseshoe Lake Game Refuge, was browsed less extensively.

In the spring of 1950, eight dead deer were found on the island of the Horseshoe Lake Game Refuge. Marrow from the femur bones was collected from two of the animals; advanced decomposition had destroyed the marrow in the other six. Judged by the tooth development and wear criteria of Severinghaus (1949), one of the deer from which marrow was collected had reached old age, which presumably contributed to its death. Analyses of the collected samples revealed 29.6 per cent fat by weight for the old animal and 14.2 per cent for the other. Malnutrition was indicated as contributing to the death of the younger animal.

On June 22, 1950, a large number of deer on the island of the Horseshoe Lake Game Refuge

were observed to be in winter pelage, which, at such a late date, is recognized as an indication of poor physical condition.

Latham (1950:22) found that the average body weight of Pennsylvania deer "has been retrogressing steadily for the past 20 or 30 years." This process occurred as the quantity of available deer food declined and its quality deteriorated.

The inaccuracies and shortcomings inherent in an attempt to judge the relative size of deer in the field are admitted. Nevertheless, with respect to the size of deer seen, it seems worthy of noting the opinion registered by the persons who were involved in the April 22, 1950, deer drive on the island of the Horseshoe Lake Game Refuge. These persons, 19 college students and 2 supervisors, William D. Carter, the project's assistant at the time, and Dr. Willard D. Klimstra, Southern Illinois University zoologist, had an excellent opportunity to observe the 168 deer that passed through the driving line, because no two adjacent drivers were ever more than 50 yards apart and the cover was relatively open. The observation that a considerable number of "very small deer" had passed through the driving line was unanimous at the conclusion of the drive.

Management

The increasing numbers of white-tailed deer in Illinois have brought about problems requiring management in areas where deer are unwanted or are in excess of the carrying capacity of the land.

In an attempt to relieve an impending food shortage on the Severson and Funderburg estates, the late Paul B. Riis, in 1940, planned an extensive planting program under the direction of the late Aldo Leopold. About 9,000 conifers, 37,500 hardwoods, 10,090 shrubs, and 284 pounds of tree and shrub seeds were to be planted. Just how completely these plans were carried out is not known; however, William I. Boetcher, who farmed, and still farms, parts of both estates, attested that a considerable amount of planting was done and that the plants survived "several years." He contended that excessive deer browsing was chiefly responsible for the failure of the planting; however, he indicated that some of the plants were plowed up.

Live trapping, attempted as a means of relieving overpopulation, reduced the deer population by about 439 head in 11 years on the island of the Horseshoe Lake Game Refuge and by 158 head in 5 years on the Rock River range. Continued high deer populations on both areas provided evidence that the trapping program did not constitute a satisfactory solution. It had the disadvantage of being costly. However, it tended to satisfy landowners that some effort was being made to resolve their deer problems.

The use of deer repellents offers a possible means of reducing the amount of damage done by deer to field and garden crops. Many different kinds of deer repellents have been tried by a number of workers in recent years with varying degrees of success. Two well-known brands were given summer and winter tests on the Severson and Funderburg estates.

In the summer of 1949, three applications of Good-rite z.i.p. were applied to a one-tenth acre plot of field corn, and three applications of Diamond "L" Brand Deer-Repellent were applied to a similar plot. One application was made when the corn was 2 feet high, one when it was 4 feet high, and one when it was in the milk. Deer were repelled from the corn sprayed with the repellents, but only until new growth appeared.

Because it was noted that deer damaged corn in the outside rows first, and then proceeded to the inside of each field, a new experiment was set up in the summer of 1950. When the corn was about 3 feet high, the four outside rows of a 30-acre cornfield were sprayed with Good-rite z.i.p. Damage ceased along these rows, but it was evident on the corn deeper in the field.

These experiments indicate that, to give a plot of growing corn adequate protection from deer, more than three applications of the repellent must be made, the applications must be made throughout the growing season, and they must be applied to all of the plants. A large amount of spray compound must be used, special equipment must be used to apply it, and considerable labor must be involved. Therefore, it is thought that the application of repellents such as those tested is an impractical way of reducing deer damage to growing corn.

Another experiment carried on in February, 1950, showed how little effect these repellents had in preventing deer use of a preferred winter food. Eight piles of slash of basswood, Tilia americana, were set out in a deer concentration area in Winnebago County on February 23. Three piles were sprayed with Good-rite z.i.p., three with Diamond "L" Brand Deer-Repellent, and two were left as controls. On examination of the

piles 5 days later, all exhibited severe browsing by deer.

The future holds several knotty problems in managing the deer herds in Illinois. Should deer be harvested on the Rock River range? It has been seen that this herd has stabilized, and that excessive damage to crops and trees has occurred on parts of the range. A bow and arrow, or possibly a shotgun, season on deer might be considered for this area. A rifle season would be dangerous to the human population.

In the southern part of the state it seems likely that an increasing number of nuisance problems will arise as a result of the increasing deer numbers there. It would seem that, after the population reaches a certain point, a wise use policy for the area would involve some kind of deer cropping system.

Literature Cited

Anonymous
1950. Recommended forest practices for Illinois hardwood timber types. Illinois Technical Forestry Association, Springfield. 17 pp. (Mimeographed.)

Barnes, William B.
1945. The white-tailed deer in Indiana. Outdoor Ind. 12(2):4-5, 16.

Bennitt, Rudolf, and Werner O. Nagel
1937. A survey of the resident game and furbearers of Missouri. Mo. Univ. Studies 12(2):1-215.

[Burlend, Rebecca]
1848. A true picture of emigration: or fourteen years in the interior of North America; being a full and impartial account of the various difficulties and ultimate success of an English family who emigrated from Barwick-in-Elmet, near Leeds, in the year 1831. 62 pp. G. Berger, London.

Cheatum, E. L.
1949. Bone marrow as an index of malnutrition in deer. N. Y. State Conservationist 3(5):19-22.

Cole, Arthur Charles
1919. The era of the Civil War, 1848-1870. Centennial History of Illinois, 3. Illinois Centennial Commission, Springfield. 499 pp.

Cory, Charles B.
1912. The mammals of Illinois and Wisconsin. Field Mus. Nat. Hist. (Pub. 153) Zool. Ser. 11. 505 pp.

De Garmo, W. R., Chester Banasiak, K. J. Chiavetta, and L. W. Ward
[1950.] Final Report, Federal Aid in Wildlife Restoration. W. Va. F. A. Project 8-R, State-Wide Wildlife Survey. Phase B—A white-tailed deer study. Conservation Commission of West Virginia, [Charleston]. 183 pp.

Gerhard, Fred.
1857. Illinois as it is; its history, geography, statistics, constitution, laws, government, finances, climate, soil, plants, animals, state of health, prairies, agriculture, cattle-breeding, orcharding, cultivation of the grape, timber-growing, market-prices, lands and land-prices, geology, mining, commerce, banks, railroads, public institutions, newspapers, etc., etc. Keen and Lee, Chicago, Ill., and Charles Desilver, Philadelphia. 451 pp.

Hurd, Harvey B.
1874. The revised statutes of the State of Illinois. A. D. 1874. Illinois Journal Company, Springfield. 1,233 pp.
1901. The revised statutes of the State of Illinois, 1901. Chicago Legal News Company, Chicago. 2,027 pp.

Jones, A. D.
1838. Illinois and the West. Weeks, Jordan and Company, Boston, and W. Marshall and Company. Philadelphia. 255 pp.

Latham, Roger M.
1950. Pennsylvania's deer problem. Pa. Game News, Spec. Issue 1. 48 pp.

Leopold, Aldo
1931. Report on a game survey of the North Central states. Sporting Arms and Ammunition Manufacturers' Institute, Madison, Wisconsin. 299 pp.

Leopold, Aldo, Lyle K. Sowls, and David L. Spencer
1947. A survey of over-populated deer ranges in the United States. Jour. Wildlife Mgt. 11(2):162-77.

[Madson, John]
1953. Iowa's early deer story. Iowa Conservationist 12(1):101.

O'Roke, E. C., and F. N. Hamerstrom, Jr.
1948. Productivity and yield of the George Reserve deer herd. Jour. Wildlife Mgt. 12(1):78-86.
Purple, N. H.
1856. A compilation of the statutes of the State of Illinois of a general nature, in force January 1, 1856, collated with reference to decisions of the Supreme Court of said State, and to prior laws relative to the same subject matter. Keen & Lee, Chicago. 2 vols., 1,491 pp.
Scott, Thos. G.
1937. Mammals of Iowa. Iowa State Col. Jour. Sci. 12(1):43-97.
Severinghaus, C. W.
1949. Tooth development and wear as criteria of age in white-tailed deer. Jour. Wildlife Mgt. 13(2):195-216.
Swears, Clayton C.
1948. There are deer in Illinois. Ill. Wildlife 3(4):12-6.
Swift, Ernest
1946. A history of Wisconsin deer. Wis. Cons. Dept. Pub. 323. 96 pp.
Wood, Frank Elmer
1910. A study of the mammals of Champaign County, Illinois. Ill. Lab. Nat. Hist. Bul. 8(5):501-613.
Woods, John
1822. Two years' residence in the settlement on the English Prairie in the Illinois country, United States, with an account of its animal and vegetable productions, agriculture, &c. &c. A description of the principal towns, villages, &c. &c. with the habits and customs of the backwoodsmen. Longman, Hurst, Rees, Orme, and Brown, London. 310 pp.